

Glossary

abbreviated electron configuration | An electron configuration that uses one of the noble gases to represent the core of electrons up to that element.

absolute zero | The minimum possible temperature, labeled 0 K (zero kelvins).

acid | An ionic compound of the cation dissolved in water.

acid dissociation constant | The equilibrium constant for the dissociation of a weak acid into ions.

acid salt | An ionic compound whose aqueous solution is slightly acidic.

activity series | A list of elements that will replace elements below them in single-replacement reactions.

actual yield | The amount that is actually produced in a chemical reaction.

addition reaction | The reaction of a halogen molecule across a C–C double or triple bond.

alkaline battery | A type of dry cell that contains an alkaline (i.e., basic) moist paste, rather than an acidic paste.

alkynes | An aliphatic hydrocarbon that contains a C–C triple bond.

alpha particle | A type of radioactive emission equivalent to a helium nucleus.

amphiprotic | A substance that can act as a proton donor or a proton acceptor.

angular momentum quantum number | An index that affects the energy and the spatial distribution of an electron in an atom. Represented by ℓ .

Aromatic hydrocarbons | A hydrocarbon that contains a benzene ring.

Arrhenius base | A compound that increases the hydroxide ion concentration in aqueous solution.

atmosphere | A unit of pressure equal to the average atmospheric pressure at sea level; defined as exactly 760 mmHg.

atom | The smallest piece of an element that maintains the identity of that element.

atomic bomb | A weapon that depends on a nuclear chain reaction to generate immense forces.

atomic mass | The weighted average of the masses of the isotopes that compose an element.

atomic mass unit | One-twelfth of the mass of a carbon-12 atom.

atomic number | The number of protons in an atom.

atomic radius | An indication of the size of the atom.

atomic symbol | A one- or two-letter representation of the name of an element.

autoionization constant of water | The product of the hydrogen ion and hydroxide ion concentrations.

autoionization of water | Water molecules act as acids (proton donors) and bases (proton acceptors) with each other to a tiny extent in all aqueous solutions.

balanced | A condition when the reactants and products of a chemical equation have the same number of atoms of all elements present.

base | A compound that increases the amount of ions in an aqueous solution.

basic salt | An ionic compound whose aqueous solution is slightly basic.

battery | A portable voltaic cell that generates electricity to power devices for our convenience.

beta particle | A type of radioactive emission equivalent to an electron.

boiling point elevation | The increase of a solution's boiling point because of the presence of solute.

boiling point elevation constant | The constant that relates the molality concentration of a solution and its boiling point change.

bond energy | The approximate amount of energy needed to break a covalent bond.

Boyle's law | A gas law that relates pressure and volume at constant temperature and amount.

Brønsted-Lowry base | Any species that can accept a proton from another molecule.

buffer | A solution that resists dramatic changes in pH.

calorimetry | The process of measuring enthalpy changes for chemical reactions.

capacity | The amount of strong acid or base a buffer can counteract.

catalyst | A substance that increases the speed of a reaction.

chain reaction | An exponential growth in a phenomenon.

Charles's law | A gas law that relates volume and temperature at constant pressure and amount.

chemical bond | The connection between two atoms in a molecule.

chemical change | The process of demonstrating a chemical property.

chemical equilibrium | The point at which forward and reverse chemical reactions balance each other's progress.

chemical nomenclature | A very specific system for naming compounds, in which unique substances get unique names.

Chemical properties | A characteristic that describes how matter changes form in the presence of other matter.

chemistry | The study of the interactions of matter with other matter and with energy.

coefficient |

The part of a number in scientific notation that is multiplied by a power of 10.

OR

A number in a chemical equation indicating more than one molecule of the substance.

cohesion | The tendency of a substance to interact with itself.

colligative properties | A property of solutions related to the fraction that the solute particles occupy in the solution, not their identity.

combined gas law | A gas law that combines pressure, volume, and temperature.

combustion reaction | A chemical reaction in which a reactant combines with oxygen to produce oxides of all other elements as products.

complete ionic equation | A chemical equation in which the dissolved ionic compounds are written as separated ions.

composition reaction | A chemical reaction in which a single substance is produced from multiple reactants.

compound | A combination of more than one element.

concentrated | A solution with a lot of solute.

concentration | The removal of solvent, which increases the concentration of the solute in the solution.

condensed structural formula | A listing of the atoms bonded to each C atom in a chain.

conjugate acid-base pairs | Two species whose formulas differ by only a hydrogen ion.

conversion factor | A fraction that can be used to convert a quantity from one unit to another.

covalent bond | A chemical bond formed by two atoms sharing electrons.

covalent network solids | A crystalline solid composed of atoms of one or more elements that are covalently bonded together in a seemingly never-ending fashion.

crystalline solid | A solid with a regular, repeating three-dimensional structure.

curie (Ci) | A unit of radioactivity equal to decays/s.

Dalton's law of partial pressures | The total pressure of a gas mixture, P_{tot} , is equal to the sum of the partial pressures of the components, .

daughter isotope | The product left over from the parent isotope in a nuclear equation.

decomposition reaction | A chemical reaction in which a single substance becomes more than one substance.

degrees | The unit of temperature scales.

Density | A physical property defined as a substance's mass divided by its volume.

derived units | A unit that is a product or a quotient of a fundamental unit.

dilution equation | The mathematical formula for calculating new concentrations or volumes when a solution is diluted or concentrated.

dipole-dipole interactions | An intermolecular force caused by molecules with a permanent dipole.

dispersion force | An intermolecular force caused by the instantaneous position of an electron in a molecule.

dissociation | The process of an ionic compound separating into ions when it dissolves.

double bond | A covalent bond composed of two pairs of bonding electrons.

double-replacement reaction | A chemical reaction in which parts of two ionic compounds are exchanged.

dry cell | A modern battery that does not contain large amounts of aqueous solution.

dynamic equilibrium | A situation in which a process still occurs but the opposite process also occurs at the same rate so that there is no net change in the system.

electrolysis | The process of making a nonspontaneous redox reaction occur by forcing electricity into a cell.

electromagnetic spectrum | The full span of the possible wavelengths, frequencies, and energies of light.

electron affinity (EA) | The energy change when a gas-phase atom accepts an electron.

electron configuration | The representation of the organization of electrons in shells and subshells in an atom.

electron groups | A covalent bond of any type or a lone electron pair.

Electron-deficient molecules | A molecule with less than eight electrons in the valence shell of an atom.

electronegativity | A qualitative scale for judging how much atoms of any element attract electrons.

electroplating | The deposition of a thin layer of metal on an object for protective or decorative purposes.

element | A substance that cannot be broken down into simpler chemical substances by ordinary chemical means.

Energy | The ability to do work.

enthalpy change | The heat of a process at constant pressure; denoted ΔH .

enthalpy of formation | The enthalpy change for a formation reaction; denoted ΔH_f .

enthalpy of fusion (or heat of fusion) | The amount of energy needed to change from a solid to a liquid or from a liquid to a solid.

enthalpy of sublimation | The amount of energy needed to change from a solid to a gas or from a gas to a solid.

enthalpy of vaporization | The amount of energy needed to change from a liquid to a gas or from a gas to a liquid.

equilibrium constant | A numerical value that relates to the ratio of products and reactants at equilibrium.

equivalence point | The point of the reaction when all the analyte has been reacted with the titrant.

exact number | A number from a defined relationship that technically has an infinite number of significant figures.

exothermic | A chemical reaction that has a negative change in enthalpy.

expanded valence shell molecules | A molecule with more than eight electrons in the valence shell of an atom.

Experiments | A test of the natural universe to see if a guess (hypothesis) is correct.

exponent | The raised number to the right of a 10 indicating the number of factors of 10 in the original number.

f block | The columns of the periodic table in which subshells are being occupied.

Formation reactions | A chemical reaction that forms one mole of a substance from its constituent elements in their standard states.

freezing point depression | The decrease of a solution's freezing point because of the presence of solute.

freezing point depression constant | The constant that relates the molality concentration of a solution and its freezing point change.

frequency | The number of cycles of light that pass a given point in one second.

fundamental units | One of the seven basic units of SI used in science.

Fusion | A nuclear process in which small nuclei are combined into larger nuclei, releasing energy.

gamma rays | A type of radioactive emission that is a very energetic form of electromagnetic radiation.

Geiger counter | An electrical device that detects radioactivity.

half reaction method | The method of balancing redox reactions by writing and balancing the individual half reactions.

half-life | The amount of time it takes for one-half of a radioactive isotope to decay.

Heat | The transfer of energy from one body to another due to a difference in temperature.

Hess's law | When chemical equations are combined algebraically, their enthalpies can be combined in exactly the same way.

heterogeneous equilibrium | An equilibrium in which more than one phase of reactants or products is present.

hydrogen bonding | The very strong interaction between molecules due to H atoms being bonded to N, O, or F atoms.

hydrogenation reaction | The reaction of hydrogen across a C–C double or triple bond, usually in the presence of a catalyst.

hydrolysis | A reaction with water.

hydronium ion | The actual chemical species that represents a hydrogen ion.

hypothesis | An educated guess about how the natural universe works.

ideal gas | A gas that exactly follows the statements of the kinetic theory.

ideal gas law | A gas law that relates all four independent physical properties of a gas under any conditions.

indicator | A substance whose color change indicates the equivalence point of a titration.

ionic bond | The attraction between oppositely charged ions.

ionic compounds | A compound formed from positive and negative ions.

ionic formulas | The chemical formula for an ionic compound.

ionic solid | A crystalline solid composed of ions.

Ionization energy (IE) | The amount of energy required to remove an electron from an atom in the gas phase.

isolated system | A system that does not allow a transfer of energy or matter into or out of the system.

isomers | A molecule with the same molecular formula as another molecule but a different structure.

isothermal | A process that does not change the temperature.

joule | The SI unit of energy.

kelvin | The fundamental unit of temperature in SI.

kinetic theory of gases | The fundamental model that describes the physical properties of gases.

lattice energy | The measured strength of ionic bonding.

law | A specific statement that is thought to be never violated by the entire natural universe.

law of conservation of energy | The total energy of an isolated system does not increase or decrease.

law of mass action | The relationship of the amounts of reactants and products at equilibrium.

Le Chatelier's principle | If an equilibrium is stressed, then the reaction shifts to reduce the stress.

Lewis electron dot diagram | A representation of the valence electrons of an atom that uses dots around the symbol of the element.

limiting reagent | The reactant that runs out first.

line spectrum | An image that contains only certain colors of light.

lone electron pairs | A pair of electrons that does not make a covalent bond.

magnetic quantum number | The index that determines the orientation of the electron's spatial distribution. Represented by m_l .

mass number | The sum of the number of protons and neutrons in a nucleus.

mass-mass calculations | A calculation in which you start with a given mass of a substance and calculate the mass of another substance involved in the chemical equation.

Matter | Anything that has mass and takes up space.

meniscus | The curved surface a liquid makes as it approaches a solid barrier.

metallic solid | A solid with the characteristic properties of a metal.

modern atomic theory | The concept that atoms play a fundamental role in chemistry.

molality | The number of moles of solute per kilogram of solvent.

molar masses | The mass of 1 mol of a substance in grams.

molar volume | The volume of exactly 1 mol of a gas; equal to 22.4 L at STP.

Molarity | The number of moles of solute divided by the number of liters of solution.

mole | The number of things equal to the number of atoms in exactly 12 g of carbon-12; equals things.

mole fraction | The ratio of the number of moles of a component in a mixture divided by the total number of moles in the sample.

mole-mass calculation | A calculation in which you start with a given number of moles of a substance and calculate the mass of another substance involved in the chemical equation, or vice versa.

mole-mole calculation | A stoichiometry calculation when one starts with moles of one substance and convert to moles of another substance using the balanced chemical equation.

molecular formula | A formal listing of what and how many atoms are in a molecule.

molecular mass | The sum of the masses of the atoms in a molecule.

molecular solid | A crystalline solid whose components are covalently bonded molecules.

molecules | The smallest part of a substance that has the physical and chemical properties of that substance.

net ionic equation | A chemical equation with the spectator ions removed.

neutral salt | An ionic compound that does not affect the acidity of its aqueous solution.

neutralization reaction | The reaction of an acid and a base to produce water and a salt.

neutron | A subatomic particle with no charge.

nonpolar covalent bond | The equal sharing of electrons in a covalent bond.

normal boiling point | The characteristic temperature at which a liquid becomes a gas when the surrounding pressure is exactly 1 atm.

Nuclear energy | The controlled harvesting of energy from fission reactions.

nuclear equation | A chemical equation that emphasizes changes in atomic nuclei.

nuclear reactor | An apparatus designed to carefully control the progress of a nuclear reaction and extract the resulting energy for useful purposes.

nucleus | The center of an atom that contains protons and neutrons.

numerical prefixes | A prefix used with a unit that refers to a multiple or fraction of a fundamental unit to make a more conveniently sized unit for a specific quantity.

octet rule | The trend that atoms like to have eight electrons in their valence shell.

Odd-electron molecules | A molecule with an odd number of electrons in the valence shell of an atom.

orbital | The specific set of principal, angular momentum, and magnetic quantum numbers for an electron.

osmotic pressure | The tendency of a solution to pass solvent through a semipermeable membrane due to concentration differences.

oxidation number | A number assigned to an atom that helps keep track of the number of electrons on the atom.

oxidation numbers | A number assigned to an atom that helps keep track of the number of electrons on the atom.

oxidation-reduction (or redox) reactions | A chemical reaction that involves the transfer of electrons.

partial pressure | The pressure that an individual gas in a mixture has.

parts per billion (ppb) | Ratio of mass of solute to total mass of sample times 1,000,000,000.

Pauli exclusion principle | No two electrons in an atom can have the same set of four quantum numbers.

percent yield | Actual yield divided by theoretical yield times 100% to give a percentage between 0% and 100%.

percentage composition by mass | Ratio of mass of solute to the total mass of a sample times 100.

periodic table | A chart of all the elements.

periodic trends | Variation of properties versus position on the periodic table.

pH | The negative logarithm of the hydrogen ion concentration.

pH scale | The range of values from 0 to 14 that describes the acidity or basicity of a solution.

photon | The name of a wave of light acting as a particle.

physical change | A change that occurs when a sample of matter changes one or more of its physical properties.

Physical properties | A characteristic that describes matter as it exists.

Planck's constant | The proportionality constant between the frequency and the energy of light.

pOH | The negative logarithm of the hydroxide ion concentration.

polar covalent bond | The unequal sharing of electrons in a covalent bond.

polyatomic ions | An ion that contains more than one atom.

precipitate | A solid that falls out of solution in a precipitation reaction.

Pressure | Force per unit area.

primary batteries | A battery that cannot be recharged.

products | A final substance in a chemical equation.

quantitative | A description of a specific amount of something.

quantized | When a quantity is restricted to having only certain values.

quantum mechanics | The theory of electrons that treats them as a wave.

rad | A unit of radioactive exposure equal to 0.01 J/g of tissue.

radioactive decay | The spontaneous change of a nucleus from one element to another.

radioactivity | Emanations of particles and radiation from atomic nuclei.

Raoult's law | The mathematical formula for calculating the vapor pressure of a solution.

rem | A unit of radioactive exposure that includes a factor to account for the type of radioactivity.

salt | Any ionic compound that is formed from a reaction between an acid and a base.

salt bridge | A part of a voltaic cell that contains a solution of some ionic compound whose ions migrate to either side of the voltaic cell to maintain the charge balance.

saturated hydrocarbons | A carbon compound with the maximum possible number of H atoms in its formula.

Science | The process of knowing about the natural universe through observation and experiment.

Scientific notation | An expression of a number using powers of 10.

secondary batteries | A battery that can be recharged.

semimetals (or metalloids) | An element that has properties of both metals and nonmetals.

semipermeable membrane | A thin membrane that will pass certain small molecules but not others.

shell | A term used to describe electrons with the same principal quantum number.

significant figures | The limit of the number of places a measurement can be properly expressed with.

single bond | A covalent bond composed of one pair of electrons.

single-replacement reaction | A chemical reaction in which one element is substituted for another element in a compound.

solubility | The maximum amount of a solute that can be dissolved in a given amount of a solvent.

solubility product constant | The equilibrium constant for a compound normally considered insoluble.

solubility rules | General statements that predict which ionic compounds dissolve and which do not.

solute | The minor component of a solution.

solution | Another name for a homogeneous mixture.

specific heat capacity | The proportionality constant between heat, mass, and temperature change; also called specific heat.

spectator ions | An ion that does nothing in the overall course of a chemical reaction.

spin quantum number | The index that indicates one of two spin states for an electron. Represented by s .

spontaneous fission (or fission) | The breaking apart of an atomic nucleus into smaller nuclei.

Standard notation | A straightforward expression of a number.

standard reduction potentials | The voltage of a reduction half reaction relative to the hydrogen half reaction.

Standard temperature and pressure (STP) | A set of benchmark conditions used to compare other properties of gases; about 1 atm for pressure and 273 K for temperature.

stoichiometry | The relating of one chemical substance to another using a balanced chemical reaction.

subshell | A term used to describe electrons in a shell that have the same angular momentum quantum number.

substance | Matter that has the same physical and chemical properties throughout.

supersaturated | A unstable solution with more than the normal maximum amount of solute in it.

Surface tension | An effect caused by an imbalance of forces on the atoms at the surface of a liquid.

surrounding atoms | An atom that makes covalent bonds to the central atom(s).

theoretical yield | An amount that is theoretically produced as calculated using the balanced chemical reaction.

theory | A general statement that explains a large number of observations.

thermochemical equation | A chemical equation that includes an enthalpy change.

titration | A chemical reaction performed quantitatively to determine the exact amount of a reagent.

torr | Another name for a millimeter of mercury.

tracer | A substance that can be used to follow the pathway of that substance through a structure.

triple bond | A covalent bond composed of three pairs of bonding electrons.

unsaturated | A solution with less than the maximum amount of solute dissolved in it.

valence shell | The highest-numbered shell in an atom that contains electrons.

valence shell electron pair repulsion (VSEPR) | The general concept that estimates the shape of a simple molecule.

van't Hoff factor | The number of particles each solute formula unit breaks apart into when it dissolves.

vapor | Material in the gas phase due to evaporation.

vapor pressure | The partial pressure exerted by evaporation of a liquid.

vapor pressure depression | The decrease of a solution's vapor pressure because of the presence of a solute.

voltage | The tendency for electrons to go from one half cell to another.

voltaic (galvanic) cell | An apparatus that allows for useful electrical work to be extracted from a redox reaction.

weak acid | Any acid that is less than 100% dissociated into ions in aqueous solution.

weak base | Any base that is less than 100% dissociated into ions in aqueous solution.